Hercules Dome – An Overview from the US-ITASE Deep Radar

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Hercules Dome (86°S, 105°W) is an elongated, approximately 100 m local rise in the ice surface topography between the Horlick and Thiel Mts. about 400 Km from S. Pole and 100 Km up flow from "The Bottleneck" linking the East and West Antarctic Ice Sheets. It was first identified by the USGS from USN aerial photographs taken in 1959-60 and further delineated by the SPRI-NSF-TUD airborne aerial radio echo sounding program in 1967-79.

The Ice Core Working Group identified Hercules Dome in reports dating from the late 1980's as a possible site for a deep ice core because of its location at the boundary between the East and West Antarctic Ice Sheets where it may have the possibility of showing changes in the WAIS over the last 200,000 years. Recent interest has been rekindled because of the US-ITASE traverse which has provided the first ground-based observations of the area.

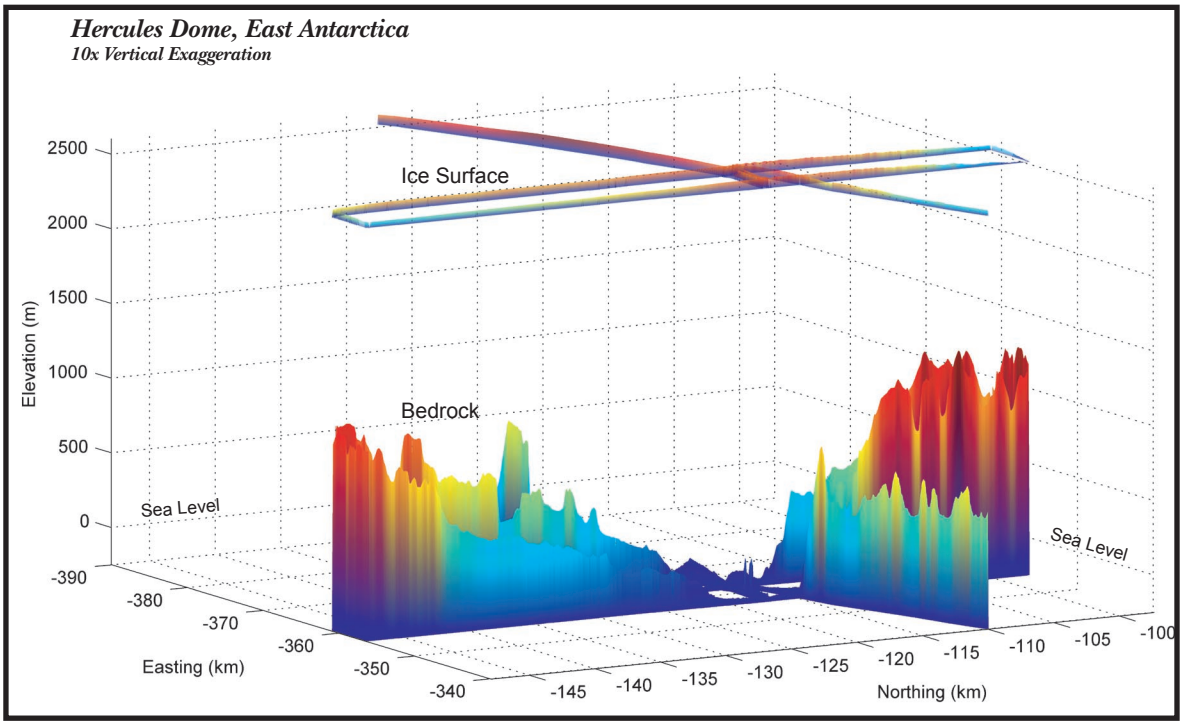

Figure 1. Bedrock and surface topography in the vicinity of Hercules Dome showing the bedrock basin, South Polar Stereographic Projection. View is looking from the East Antarctic Ice Sheet toward the "Bottleneck" and the Antarctic Peninsula. Main traverse route (single profile) runs approximately north to south.

The dome appears to be slightly mislocated in the RAMP DEM because of errors that increase above ~ 83°S. GPS results from the ITASE traverse (Spikes and Hamilton, this meeting) place the dome summit approximately 20 km west of where it appears in the RAMP DEM at an elevation of 2600 m. Similar or slightly larger errors may also exist in the north-south location. BEDMAP depictions of the bed topography of the area are derived from coarsely-spaced 50x100 Km grid

lines of the SPRI-NSF-TUD survey, none of which actually cross the dome.

During the three days the US-TASE traverse spent at Hercules Dome we completed some 120 km of radar profiling in an elongated grid pattern approximately 5 by 50 Km and roughly perpendicular to the main traverse route. Bed topography and internal stratigraphy down to 70% of the ice thickness is well-depicted in these surveys and we have picked the bed and a number of prominent, continuous internal layers from these profiles.

These data reveal that Hercules Dome is approximately centered over a bedrock low, possibly a basin, some 30-50 Km in extent (Figure 1). The greatest ice thickness under the dome area is 2800 meters with bedrock elevations 200 meters below sea level. Within 15 to 25 Km in each of the directions surveyed, the bed rises 900 to 1400 meters from the low under the dome.

Internal stratigraphy (Figure 2) is well-behaved throughout the dome region in contrast to nearby areas along the traverse route which show marked disruptions of internal layers (Welch et al., this meeting). Although model studies will be required to explore details more fully, it appears that ice flow in the vicinity of the dome has not undergone major changes throughout at least the period of time represented by the upper 2000 meters of ice thickness. Although prominent internal reflectors can be traced for several hundred kilometers, we are not able to follow them continuously to Byrd Station or to identify the internal layer pattern with dated horizons from the Byrd core as we have with other US-ITASE segments in the WAIS. Other US-ITASE experiments should soon be providing additional glaciological information on Hercules Dome including modern accumulation rates, shallow radar, ice core chemistry and surface velocity.

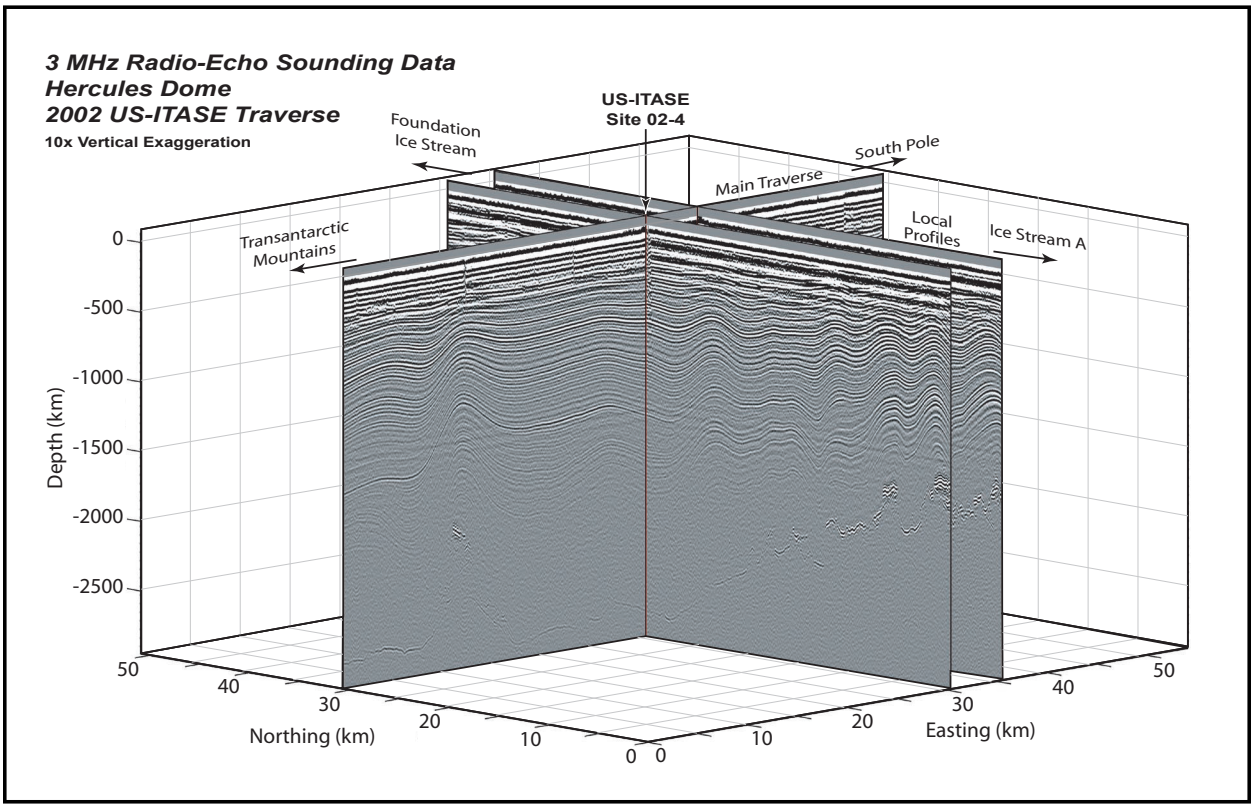

Figure 2. Bed and internal stratigraphy in the vicinity of Hercules Dome, South Polar Stereographic Projection. Profiles are plotted with perpendicular intersection for clarity.